Jet Propulsion Laboratory

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Deployed high-gain antenna will soon send streams of new Mars images

MGS images to be received on Earth next week

By MARY HARDIN

A steady stream of new data from Mars, including high-resolution images, will begin arriving next week at Earth receiving stations following the March 29 deployment of the Mars Global Surveyor's high-power communications antenna.

"Having a deployed, or steerable, high-gain antenna is like switching from a garden hose to a fire hose in terms of data return from the spacecraft," said Joseph Beerer, flight operations manager for Mars Global Surveyor at JPL. "We now have a steady stream of data.

"Up until now, we have been using the high-gain antenna in its stowed position, so during the first three weeks of our mapping mission, we had to stop collecting science data and turn the entire spacecraft periodical-

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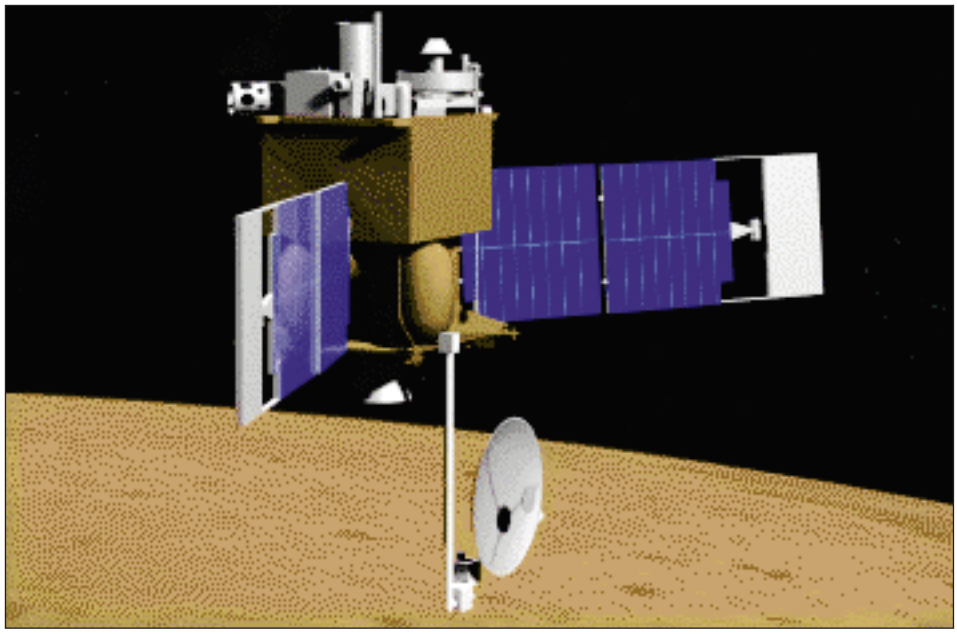


Mars Global Surveyor's high-gain antenna is showed in its deployed position.

Mars '01 experiment lays groundwork for 'living off the land'

NASA engineers have succeeded in a realm often left to alchemists and magicians—creating something valuable "out of thin air." In this case, the thin air was a simulated Martian atmosphere, and the valuable commodity was oxygen.

"The concept is to use the resources on Mars to reduce the amount of material that needs to accompany a human mission ... to 'live off the land,'" said David Kaplan, principal investigator of the Exploration Office at NASA's Johnson Space Center, Houston. "Producing oxygen using materials readily available on Mars would be an important step toward reducing the costs and risks of an eventual human mission to Mars."

The late-March demonstration was an initial test of technology that will be aboard the JPL-managed Mars Surveyor 2001 Lander, scheduled to launch April 10, 2001, and land on Mars on Jan. 22, 2002. Called the Mars In-Situ Propellant Production Precursor, the experiment will test the feasibility of using the thin Martian atmosphere to produce oxygen for breathing air and propellants. Propellants created on Mars could eventually be used to send samples and astronauts back to Earth.

"The oxygen production technology that was tested is based on sound, straightforward chemistry," said Jerry Sanders of Johnson's Propulsion and Fluid Systems Branch.

The primary test involves an experimental device inside a Mars environment chamber that selectively absorbs carbon dioxide from a simulated Martian atmosphere—called "Mars mix"—and converts it to oxygen. This technology also may be used to extract pure oxygen from Earth air for home, medical and military needs.

The atmosphere inside the experiment chamber simulates Martian temperatures and atmospheric pressures. The "Mars mix" is 95 percent carbon dioxide, thin (almost 150 times thinner than Earth's atmosphere) and cold (minus 75 degrees Centigrade, minus 105 degrees Fahrenheit) like a typical Martian night.

The mix provides the feedstock for the chemical reaction. A wafer-thin, solid-oxide ceramic disk made of zirconia, about the size of a small cookie, is sandwiched between two platinum electrodes and heated to 750 degrees Centigrade (1,380 degrees Fahrenheit). When carbon dioxide is fed to this unit, the zirconia cell "cracks" the carbon dioxide into carbon monoxide and oxygen. Only the oxygen can penetrate through to the other side of the disk; the carbon dioxide and carbon monoxide gases are stopped in their tracks.

The Mars Surveyor 2001 Lander is expected to provide essential insights into how to conduct successful, cost-effective human missions to Mars. The lander's primary science goal is to explore the mineralogy of the landing site, near

See Mars '01, page 6

Daughters, sons to join parents at work on April 22

'The Future Is Me' is theme for annual on-Lab event

By ALICE FAIRHURST
Staffing and Professional Development

JPL is celebrating the seventh Take Our Daughters to Work Day on April 22 with the theme "The Future Is Me!"

This yearly national celebration honors girls; however, both boys and girls are eligible to participate in the JPL events. If your child wonders what you do at work all day, you'll have the perfect opportunity to demonstrate your activities as your child "shadows" you at work. To enhance your child's sense of curiosity and wonder, special science and engineering demonstrations will be held.

The purpose of this day is to give young people a glimpse of their own future potential and help them make the crucial connections between education and their future development.

Take Our Daughters to Work Day was conceived in response to research conducted by Harvard University and the American Association of University Women on the adolescent development of girls. The study found that girls suffer from lower expectations than do their male counterparts.

See Daughters, page 7

Special Events Calendar

Ongoing

Alcoholics Anonymous—Meeting at 11:30 a.m. Mondays, Tuesdays, Thursdays (women only) and Fridays. For more information, call Occupational Health Services at ext. 4-3319.

Codependents Anonymous—Meeting at noon every Wednesday. For more information, call Occupational Health Services at ext. 4-3319.

Gay, Lesbian and Bisexual Support Group—Meets the first and third Fridays of the month at noon in Building 111-117. For more information, call employee assistance counselor Cynthia Cooper at ext. 4-3680 or Randy Herrera at ext. 3-0664.

Parent Support Group—Meets the fourth Tuesday of the month at noon. For location, call Jayne Dutra at ext. 4-6948.

Senior Caregivers Support Group—Meets the second and fourth Wednesdays of the month at 6:30 p.m. at the Senior Care Network, 837 S. Fair Oaks Ave., Pasadena, conference room #1. Call (626) 397-3110.

Friday, April 2

JPL Dance Club—Meeting at noon in Building 300-217.

Tuesday, April 6

JPL Gamers Club—Meeting at noon in Building 301-227.

JPL Genealogy Club—Meeting at noon in Building 301-169.

Wednesday, April 7

Associated Retirees of JPL/Caltech Board—Meeting at 10 a.m. at the Caltech Credit Union, 528 Foothill Blvd., La Cañada.

JPL Drama Club—Meeting at noon in Building 301-127.

Russian Language Workshop—Meets from 7 to 9 p.m. on the Caltech campus. Some knowledge or previous study of the language is essential. For location and further information, call Joyce Wolf at ext. 4-7361.

Friday, April 9

"An Evening with Jonathan Miller"—The author, lecturer, director and producer will give a free lecture at 8 p.m. in Caltech's Beckman Auditorium. For information, call (626) 395-4652.

JPL Dance Club—Meeting at noon in Building 300-217.

JPL Drama Club—Meeting at noon in Building 301-127.

Russian Language Workshop—Meets from 7 to 9 p.m. on the Caltech campus. Some knowledge or previous study of the language is essential. For location and further information, call Joyce Wolf at ext. 4-7361.

Fri., Apr. 9–Sat., Apr. 10

All-Mozart Concert—The Caltech Chamber Singers and Chamber Music Ensembles will perform at 8 p.m. in Caltech's Dabney Lounge. Admission is free. For information, call (626) 395-4652.

Saturday, April 10

Ballet Folklorico Quetzalli de Veracruz—The dance troupe will perform at 8 p.m. in Caltech's Beckman Auditorium. Tickets are $25, $21 and $17. For information, call (626) 395-4652.

Sunday, April 11

Chamber Music—The Guarneri String Quartet will perform at 3:30 p.m. in Caltech's Beckman Auditorium. Tickets are $25, $21, $17 and $13. For information, call (626) 395-4652.

Tuesday, April 13

JPL Stamp Club—Meeting at noon in Building 183-328.

Wednesday, April 14

"Ballistic Missile Defense Revisited"—Richard Garwin, senior fellow for science and technology at the Council on Foreign Relations in New York, will speak at 8 p.m. in Caltech's Beckman Auditorium. Admission is free. For information, call (626) 395-4652.

JPL Amateur Radio Club—Meeting at noon in Building 238-543.

JPL Drama Club—Meeting at noon in Building 301-127.

JPL Toastmasters Club—Meeting at 5:30 p.m. in the Building 167 conference room. Guests welcome. For more information, contact Mary Sue O'Brien at ext. 4-5090.

Russian Language Workshop—Meets from 7 to 9 p.m. on the Caltech campus. Some knowledge or previous study of the language is essential. For location and further information, call Joyce Wolf at ext. 4-7361.

SESPD Lecture Series—Doug Bernard of Section 341 will give a lecture titled, "Taking the Next Step in Spacecraft Autonomy: The Remote Agent Experiment on Deep Space One." At 11 a.m. in Building 180-101.

Thursday, April 15

JPL Astronomy Club—Meeting at noon in Building 198-102.

Von Kármán Lecture Series—Dr. Ken Nealson, lead scientist in JPL's Astrobiology Research Element, will speak at 7 p.m. in von Kármán Auditorium. Open to the public.

Friday, April 16

JPL Dance Club—Meeting at noon in Building 300-217.

Von Kármán Lecture Series—Dr. Ken Nealson, lead scientist in JPL's Astrobiology Research Element, will speak at 7 p.m. in The Forum at Pasadena City College, 1570 E. Colorado Blvd. Open to the public.

Sunday, April 18

Chamber Music—The Viklarbo Chamber Ensemble will give a free concert at 3:30 p.m. in Caltech's Dabney Lounge. For information, call (626) 395-4652.

Hydrogen peroxide detected on Europa

By JANE PLATT

Hydrogen peroxide—the chemical that can turn a brunette into an instant blonde—appears on the icy surface of Jupiter's moon Europa, according to a new discovery by JPL's Galileo spacecraft reported in the March 26 edition of the journal Science.

"Hydrogen peroxide is a really weird chemical that reacts strongly with almost everything," said Dr. Robert Carlson, principal investigator for Galileo's near-infrared mapping spectrometer instrument, the device that detected the chemical on Europa. Hydrogen peroxide is formed constantly on Europa as Jupiter's energetic particles smash apart molecules on the surface to produce new chemicals, Carlson said. This process is called radiolysis.

"We expect to find more bizarre materials on Europa, because it's constantly bombarded by Jupiter's intense particle radiation environment," Carlson said.

Hydrogen peroxide does not appear naturally on Earth's surface, partly because the surface is not hit by enough radiation to initiate the process that creates the chemical. "On Earth, if we want hydrogen peroxide, we have to make it in factories," Carlson said.

"Almost as soon as hydrogen peroxide is formed, it starts breaking down," Carlson explained. "It's either destroyed by ultraviolet light or changed by contact with other chemicals, so its life span on Europa is only a few weeks to months." The hydrogen peroxide becomes another reactive chemical called hydroxyl, and can ultimately produce oxygen and hydrogen gas, Carlson said.

Because Europa's surface chemicals are constantly being made and destroyed, it's hard to study its long-term chemical history, Carlson said. "On the other hand, we are interested in watching changes in chemical composition over short periods of time. By studying chemical processes on Europa and the other moons of Jupiter, we can learn more about how those moons interact with Jupiter, and how similar processes occur elsewhere in our solar system."

Galileo's near-infrared mapping spectrometer works like a prism, breaking up infrared light that is not visible to the naked eye. Since different chemical molecules absorb infrared light differently, scientists can study the light patterns and determine what chemicals are present. In this case, the instrument was used to study infrared light from Europa's surface, and it detected dark areas of hydrogen peroxide. The human eye would not normally see the hydrogen peroxide on Europa, because it is dissolved in surface ice and has no color.

Galileo's instruments had previously detected several other chemicals on Europa's surface, including sulfur dioxide, water ice, carbon dioxide and possibly salt molecules containing water. Carlson and other scientists will have another chance to study the chemistry of Europa's surface when the Galileo spacecraft flies by Europa on Nov. 25. ❑

Huntress named JPL Distinguished Visiting Scientist

Former NASA Associate Administrator for Space Science Dr. Wesley Huntress has been named to the position of Distinguished Visiting Scientist at JPL by Laboratory Director Dr. Edward Stone.

The purpose of the visiting scientist program is to bring to the Laboratory, on either short-time or part-time basis, leading scientists who will enrich JPL's programs, according to JPL Chief Scientist Dr. Moustafa Chahine, who will host Huntress during his presence on Lab.

Dr. Wesley Huntress

Huntress, who led the agency's space science office from 1993-98, will work with JPL on its recently implemented Grand Challenge initiative, particularly in areas of astrobiology. He will also advise on basic research activities and processes within the JPL domain of Generate Scientific Knowledge, said Chahine, who oversees the Grand Challenge initiative.

Huntress is currently director of the Geophysical Laboratory at Carnegie Institution of Washington, D.C. Prior to joining NASA Headquarters, he worked in research and management at JPL starting in 1969. He was a senior research scientist in astrochemistry in the Earth and Space Sciences Division and was appointed Visiting Professor at Caltech.

"Dr. Huntress will be returning back to familiar grounds to interact with many familiar colleagues," Chahine said. ❑

Mars Exploration, SESP directorates to merge

Laboratory Director Dr. Edward Stone has announced a twofold plan to better facilitate JPL's efforts within NASA's exploration of an initiative to establish long-term robotic outposts for sustained presence on Mars.

In a memo to employees, Stone announced a reorganization of part of JPL's organizational structure. Mars Exploration Program Director Norm Haynes has begun work with a new a team that will work with other NASA centers to plan the initiative. At the same time, the Mars Exploration and the Space and Earth Science Programs directorates are being consolidated in a single directorate under the leadership of Dr. Charles Elachi.

"There's no question in my mind that Mars outposts will be a key element for JPL in the 2005-15 time frame," said Elachi. "It's essential that we plan for it appropriately and with the right vision. Norm is ideal for such a role. In addition, by merging the two directorates, we now have a structure that will facilitate coordination of strategic planning and mission implementation for planetary exploration in the future.

"We will try to simplify interfaces with NASA Headquarters," he added. "Internally, we will try to have more efficient use of our facilities and our investments in technologies and advanced systems."

Elachi said that over the next few months, he will seek "the best way to merge the two organizations." Currently, no other personnel changes are planned.

Haynes' new role will be to continue as co-chair of the NASA-wide Human Robotic Team, a group that will develop plans in the areas of mission planning, technology, life science, space science and public engagement. Doug Cooke, manager of Johnson Space Center's Advanced Development Office, is the other co-chair of the team, which will probably include four other members from JPL and JSC, in addition to a point of contact from each of the other centers, Haynes said. The team's charter will be expanded to include robotic outposts, he added.

"We will need to develop a variety of scenarios and options, rather than a single roadmap for robotic outposts," Haynes said. "The trick will be to find a site on Mars that is scientifically engaging, and, at the same time, is a good site for an eventual human base on the planet."

The team will begin to meet in mid-April. Its preliminary report to NASA Headquarters will be delivered in early July. ❑

News Briefs

The winners of JPL's Notable Value-Added (NOVA) awards for March have been announced:

Element 3237: I-Lin Tang.

Section 331: Payman Arabshahi, Abhijit Biswas, Chien-Chung Chen, Andrew Gray, Hamid Hemmati, Gail Huddleston, Muthu Jeganathan, Shinhak Lee, Gerardo Ortiz, Timothy Pham, Patricia Priest, Caroline Racho, John Sandusky, Martin Slade III, Meera Srinivasan, Charles Wang, Keith Wilson, Tsun-Yee Yan.

Section 350: Patricia Detweiler, Elsa Payan-Velazquez, Ron Reeve.

Section 352: John Alpay, Ipek Basdogan, John Biles Jr., Gregory Davis, Brian Harrington, John Henrikson, Theodore Iskendarian, Michael Johnson, Gerhard Klose, Donald Lewis, Tenny Lim, James McGown, Timothy Newby, Gary Ortiz, Yuki Salinas, Joseph Sanok, Paul Willis.

Section 354: Jennifer Dooley, Patricia Hayes-Rowe, Brett Kennedy, Christian Lindensmith, Laura Newlin.

Section 361: William Heventhal III, William Taylor.

Section 380: Lori Flannery, Victor O'Brien.

Section 387: Valerie Duval.

Section 388: Kris Capraro, Eliz-abeth Duxbury.

Section 395: Gary Gutt, Shannon Jackson, Mark Kordon, Nicolas Rouquette, Kathy Zamora. ❑

The JPL Library will celebrate National Library Week on Tuesday, April 13 from 9 a.m. to 4 p.m. in the west end of Building 111. The program will include demonstrations of the newest Bibliographic and Electronic Access Connection (BEACON) web resources.

Refreshments will be available in the library reference area. Also, Library and Archives staff will be present to answer questions about resources and services. There will be a book drawing for NASA Special Publications throughout the day.

Demonstrations last for 20 minutes and will be held in Room 111.

For more information, call the reference desk at ext. 4-4200. ❑

Dr. John Dick, a member of the Time and Frequency Sciences and Technology Group in Section 335, has been awarded this year's European Time and Frequency Award, created by the European Time and Frequency Forum.

The award, granted every two years since 1993 by the French Society of Microtechnology and Chronometry, recognizes exceptional contributions providing worldwide recognition either for fundamental advances or for present or future applications. Dick was granted the award for "contributions in the fields of atomic frequency standards physics, of cryogenic oscillator technologies, and of low noise electronics and measurements systems."

Dick will receive a cash award of 10,000 French francs (about $1,780) and a limited-edition original print and certificate.during a joint meeting of the European Time and Frequency Forum and the Institute of Electrical and Electronics Engineers' Frequen-cy Control Symposium on April 14 in Besancon, France. ❑

The JPL/Caltech Child Educational Center (CEC) will hold its annual Celebration of Community Sunday, April 18 from 3 to 6 p.m. at its main site at 140 Foothill Blvd., La Cañada.

The event celebrates the non-profit CEC's 20th year of operation and also recognizes outstanding service to the program by parents, staff and community members. Also included will be children's activities, entertainment and dinner.

The nationally accredited center serves children of two months to four years of age at its main site. In addition, its after-school program serves children in kindergarten to sixth grade through sites at Caltech as well as Paradise Canyon, La Cañada and Palmcrest elementary schools in La Cañada.

Tuition assistance is available to qualifying JPL and Caltech families, as is priority enrollment.

To learn more about CEC programs, call ext. 4-3418 or go to the organization's web site at http://eis.jpl.nasa.gov/hrext/cec . ❑

The JPL/Caltech Flying Club will hold its spring membership meeting on Wednesday, April 14 at 7:30 p.m. at 269 Lauritsen Hall on the Caltech campus.

Guest speaker for this meeting is **John Copeland**, producer of the Babylon 5 series, who will discuss his experience in researching and producing a documentary about the Flying Tigers in the World War II era. Following the presentation, the club's board elections will be held for the next year.

The club maintains six aircraft at the El Monte Airport for the use of its members. The club accepts the majority of its membership from the JPL/Caltech community, with outside memberships also accepted on a space available basis.

For more information, call **Bob Ferber** at ext. 4-3463. ❑

Lab educators help Lakota welcome springtime

By JANE PLATT

In a unique marriage of high-tech science and traditional Native American teachings, JPL science educators and the Lakota Nation welcomed the arrival of spring and exchanged knowledge of the stars in the Black Hills of South Dakota March 19-21.

During the traditional Lakota Spring Gathering of more than 1,000 members of the Lakota Nation, Lakota elders shared their traditional star teachings, and JPL educators provided telescopes and computers as astronomy aids.

"We hope we have excited Lakota youth about NASA space science and want to see what we can learn from this cultural interchange," said JPL science educator Richard Shope. "We are exploring the connections between recent space findings and traditional Lakota star knowledge."

"My people once hunted for buffalo—now we hunt for knowledge," said Chief Joseph Chasing Horse, spiritual leader for the event. For the Lakota people, the Spring Gathering marks the time when the Sun travels with the traditional Dried Red Willow constellation. Throughout Lakota history, it was a time of migration for hunters who followed the movements of buffalo herds.

The gathering included students from eight rural tribal schools, along with their family and friends. On Saturday, March 20, JPL science educators hosted a star-watching session, providing telescopes, binoculars and computers as astronomy education aids for students who participated in hands-on, interactive astronomy lessons.

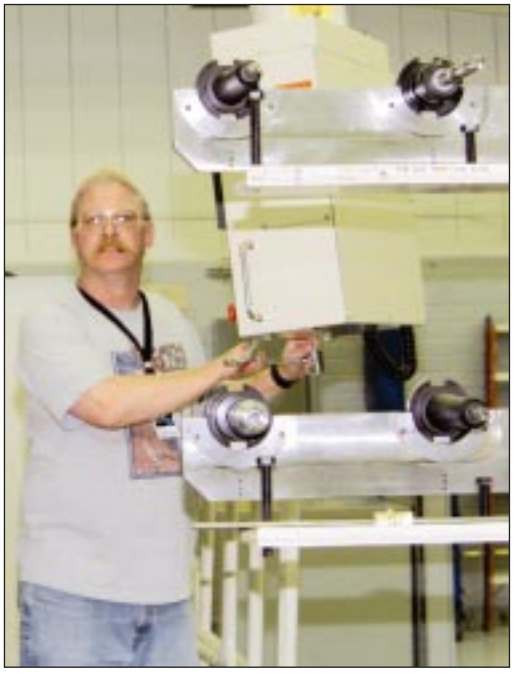
On the first day of spring—Sunday, March 21, known as the vernal equinox—the Lakota hosted a ceremonial hike, and Lakota elders shared their traditional star knowledge through talking circles, singing and dancing.

"We have come to your classroom, and we now invite you to come into our classroom," said Chasing Horse. In a program sponsored by NASA's Native American Initiative, he is working with JPL representatives to help develop education materials that join traditional Lakota teachings with modern science. Chasing Horse, a direct descendant of the spiritual leader Crazy Horse, serves as ambassador to the United Nations for the Lakota Sioux Nations.

At the Black Hills gathering, JPL presented to the Lakota people several large prints of an image of the Black Hills as taken from the space shuttle.

JPL participated in the event through a program called "From the Outer Planets to the Inner City," designed to bring space science to urban and rural classrooms. JPL staff members attending the Black Hills gathering included representatives of the Laboratory's Outer Planets/Solar Probe project, the Cassini mission to Saturn and the Telescopes In Education program.

A larger, public gathering to mark the arrival of summer will be held from June 21 to 25 in the Black Hills. ❑



A new horizontal boring mill, left, provides modifications and alignment on a Cassini gravity wave antenna, at left, which will soon move to the Deep Space Network facility at Goldstone. Thomas McKeown, above, programs the machine.

New capabilities help to make a faster, better, cheaper machine shop

By MARK WHALEN

In recognition of its ongoing process improvements in mechanical fabrication, Section 357 last month dedicated several new tooling machines in its Building 170 machine shop.

By replacing some decades-old, manually operated machinery for which replacement parts were unavailable, the effort signifies the start of a new era in meeting the Lab's fabrication needs. The new computerized, multi-axis machines will allow mechanical staff to produce complex parts more quickly and with much more precision than ever before.

To stay current with JPL's development of new products and technologies, Section 357 Manager William Revere said his staff now has increased capability to meet a critical engineering challenge: the "art-to-part" design method, a commonly used set of integrated computer-aided tools used concurrently in the development of spacecraft hardware.

Depending on the size and complexity of an order, he said, manufacturing jobs that have taken weeks to complete in the past can now be finished in days, or even hours.

"An engineer can draw up a design on a computer, send it here and have the tool path to the machine a matter of minutes, which would take hours before," noted Darrol Houser, supervisor of the Prototype and R&D Machining Group.

Better precision is another key element of the machinery. Positioning accuracy within two microns (8/100,000 of an inch) will be able to meet the fabrication requirements of almost all spacecraft instruments currently in design at JPL, Houser said.

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Cutting a ribbon to dedicate new Building 170 machinery are, from left, William Revere, Section 357 manager; Brian McGlinchey, Division 350 manager; Kirk Dawson, JPL associate director; and Darrol Houser, supervisor of the Prototype and R & D Machining Group.

Science exhibits fill von Kármán

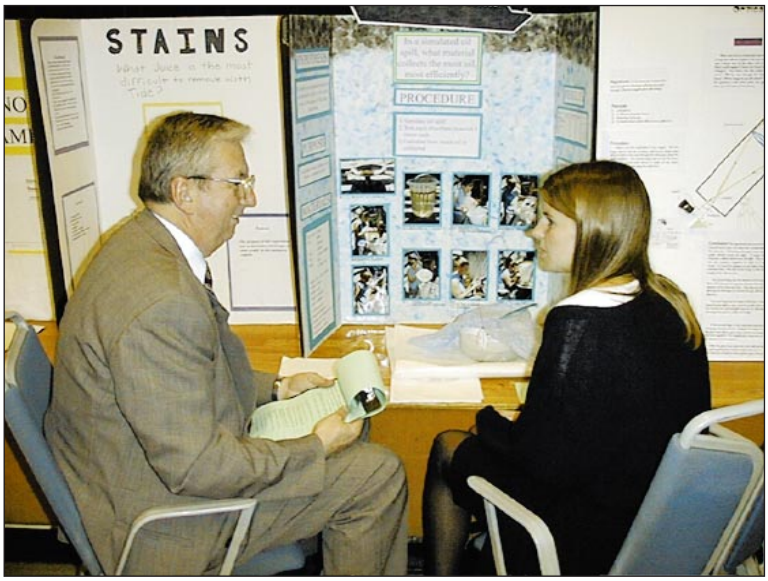
Thirteen-year-old Lauren Donnelly-Crocker, an eighth grader at Eliot Middle School in Altadena, was interested in testing her theories on oil spills. What material collects the most oil, most efficiently, she wondered, experimenting with rice, cotton and other absorbents.

Meanwhile, Astrid Overholt, 11, a sixth grader at the school, used mice to try to understand the affects of music on learning. Classical music, she found, was most helpful to the mice in learning new tasks.

These and 153 other science experiments combined to fill von Kármán Auditorium last week as part of the annual Eliot Middle School/ JPL Science Fair.

About 50 JPL scientists and engineers volunteered to serve as judges of this year's entries, which were later trimmed to a maximum of 27 finalists. The fair culminated in an awards ceremony on the evening of the fourth day. This fall, all the winners will be treated to a special dinner at JPL for their achievements.

In 1981, JPL adopted Eliot Middle School. Each March ever since, the school's sixth- through eighth-graders have enthusiastically participated in the Eliot/JPL Science Fair, producing colorful exhibits explaining their science experiments. To develop their individual concepts, students are encouraged to conduct extensive preliminary research, including interviewing experts in the field in universities and research laboratories throughout the United States, when appropriate. ❑



Cassini scientist Dr. Ellis Miner consults with eighth-grader Lauren Donnelly-Crocker on her oil-spill experiment during last week's science fair.

MGS

Continued from page 1

ly to transmit data to Earth," Beerer explained. "Now that the high-gain antenna is deployed and steerable, we have the ability to simultaneously make measurements of Mars and communicate with Earth without turning the spacecraft."

The antenna was deployed about 9:30 p.m. Pacific time Sunday, March 28. It had been stowed since launch in November 1996 to reduce the chances of it being contaminated by the exhaust plume from the spacecraft's main engine, which was fired periodically throughout the mission. The spacecraft entered orbit around Mars in September 1997 and used aerobraking to gradually lower the spacecraft's altitude to the desired orbit for mapping. The mapping mission began March 9; full-scale mapping begins April 4.

Because engineers were uncertain that a device intended to dampen the force of the deployment would work correctly, engineers used the antenna in its stowed configuration for the first three weeks of mapping. This allowed the team to meet the mission's minimum science objectives before risking the antenna deployment.

In the evening of March 29, the 1.5-meter-diameter (4.9-foot) dish-shaped high-gain antenna was deployed on a 2-meter-long (6.6-foot) boom and was pushed outward from the spacecraft by a powerful spring. A damper mechanism cushioned the force of the spring and limited the speed of the deployment, somewhat similar to the piston-like automatic closer on a screen door. With the antenna successfully deployed, Mars Global Surveyor will return a nearly constant stream of observations of Mars for the next two years.

Information from the science instruments are recorded 24 hours per day on solid-state recorders onboard the spacecraft. Then the data are transmitted to Earth once a day, during a 10-hour tracking pass over a Deep Space Network antenna. In addition, every third day a second tracking pass is used to transmit data "live" at a very high rate directly to Earth without being put on the spacecraft's onboard recorder. These data, which will contain high-resolution images of Mars, will be transmitted at rates between 40,000 and 80,000 bits per second. ❑

Machine

Continued from page 5

With more than 70 percent of machining tasks being done off-Lab by vendors, the shop's new capabilities make it possible to machine a wider range and more complex parts than it could before, allowing the shop to recover from a vendor's scheduling errors or mistakes, he said.

The largest of the new machines took several months to install and adjust. Four older machines were surplused to make way for the new horizontal boring drill, which required an 11-1/2-foot pit to be carved out of the shop floor to accommodate the accuracy requirements JPL requested of the manufacturer.

"During the construction phase, even with all the noise, dust and fumes, our people kept working," Houser said. "It's a tribute to the quality and dedication of our people that their output never varied."

Houser said the price tag of about $2.3 million for three units manufactured by Mitsubishi of Japan "saved the section, JPL and the government a lot of money. It would be the equivalent of receiving the horizontal machining center (one of the newly purchased machines) for free. By purchasing the three together, we received a discount of about 25 percent, which is unheard of in the machine tool industry."

Revere said the new tooling capabilities are being implemented in concert with the section's other recent process improvement efforts. Business changes—which include a "quick order" desk for tasks that take less than a half day's work, and the online Smart Shop Manager for shop scheduling—increase the efficiency of the section. Manufacturing engineers help cognizant engineers by influencing the designs, planning and tracking the fabrication and assembly work at JPL and at outside vendors. ❑

Mars '01

Continued from page 1

the Martian equator, by taking visible and infrared pictures of the surrounding terrain and deploying a rover similar to Mars Pathfinder's Sojourner. Other equipment will analyze the Martian soil and surface radiation. ❑

Daughters

Continued from page 2

Fewer girls than boys envision themselves in the fields of science, mathematics, engineering and other technical fields. Spending a day in the workplace helps girls examine their own potential and helps all youngssters to see these careers as more real and attainable.

Last year at JPL, more than 300 young people from ages 9 through 17 participated with their mothers, fathers, aunts, uncles, grandparents and friends. The event is open to JPL employees and contractors.

For an application to bring a child to work, or for more information about the specific activities, see the following web site: http://eis.jpl.nasa.gov/acw/acw.html. Carmen Nunez-Morton is coordinating this event, which is sponsored by the Advisory Council for Women, Advisory Committee on Minority Affairs, Human Resources, Ombuds, Public Services, and Security and Plant Protection. ❑

Passings

Leonard Ely, 77, a retired senior test specialist from Section 351, died of heart failure March 3 at a Michigan nursing home.

Ely joined JPL in 1944 and was a Laboratory employee for 21 years. He later returned as a contract employee until his retirement in 1986.

He is survived by his wife, Sandra, son David and three grandchildren.

Services were held in Coldwater, Mich. ❑

John Short, 78, a retired engineer from Section 384, died of cancer March 22 at his Lancaster home.

Short worked at JPL from 1968–83. He is survived by his wife, Margaret, and sons John, Jeffrey and Ronald.

Burial was at Lancaster Community Cemetery. ❑

Marvin Taylor, 77, a retired senior contract negotiator from Section 621, died of respiratory failure March 22 at his home in Redding, Calif.

Taylor joined JPL in 1962 and retired in 1979. He is survived by his wife, Virginia, son Thomas, three grandchildren and two great-grandchildren.

Services were private. ❑

Retirees

The following employees retired in April:

Maynard Hine, 44 years, Section 990; **Robert Tausworthe**, 41 years, Section 360; **John Poretta Jr.**, 40 years, Section 212; **Ilene Sharp**, 39 years, Section 314; **Marc Trummel**, 39 years, Section 515; **Ronald Draper**, 38 years, Section 990; **Daryal Gant**, 36 years, Section 600; **Brian McGlinchey**, 36 years, Section 350; **Victor O'Brien**, 35 years, Section 380; **Nellis Adams**, 33 years, Section 830; **John Johnson**, 32 years, Section 314; **Darrell Schmit**, 30 years, Section 516; **Pamela O'Brien**, 29 years, Section 212; **Dorothy Adams**, 25 years, Section 311; **Richard Lemon**, 21 years, Section 345; **James Schroeder**, 18 years, Section 354; **Gerald Halpert**, 16 years, Section 346; **Donna Frandsen**, 16 years, Section 600; **John Ovnick Jr.**, 15 years, Section 333; **Larry Combes**, 13 years, Section 516; **Raymond Schliesmann**, 13 years, Section 344. ❑

LETTERS

My wife Dianne and I would like to extend our deepest gratitude to all our friends at JPL who supported us during the recent passing of Dianne's mother. Your cards, flowers, plants, wise counsel and other expressions of genuine kindness served to make this difficult period significantly more bearable. Thank you for being there.

Richard Kee

❑❑❑

The retirement party that you held for me on March 9, 1999 was a truly memorable and fun event. Thank all of you who attended and also those who couldn't but called or sent cards instead. A special thanks goes to those who worked so hard to make it happen. You were most generous in the amount of cash you gave me to obtain the printer and scanner that I have been wanting. The printer has been purchased and the scanner is in the final stages of selection. I cannot adequately express how happy and proud I am to have participated with you in doing the things that we have done at JPL during the last 40 years. Thanks for the memories.

Larry Wright

❑❑❑

Thanks to my JPL friends for the many expressions of sympathy and to the ERC for the beautiful plant following the recent death of my mother. These comments were most appreciated and made a difficult time a bit easier.

Charlie Beswick

FOR SALE

AIRLINE VOUCHER, SouthWest, fully transferable, expires 8-30-99; worth $414, sell for $314. 626/792-8113, Steve.

BASEBALL/FOOTBALL CARDS, 200 assorted; major stars, rookies and inserts; will include favorite teams/players, $20. 626/914-6083.

BBQ, portable gas grill, $15. 213/617-2398.

BED, twin, exc. cond., $150. 310/392-2190.

BIRD, janday conure with cage, can be handled, very sweet, good conversationalist, $100. 626/791-0809.

BOXES, used cardboard, for files, suitable for moving or storage, 200 available, 10 for $5. 367-0969.

BREADMAKER, makes breads, jams, etc., $50. 213/617-2398.

CANOE, Old Town Hunter, 13" Royalex skid pads & flotation, $250. 626/794-4592, Dan.

BUNK BED, Swedish white pine, matching shelf & drawers, 2 twin mattresses; high quality, vg condition, $125/obo. 952-8803.

CD PLAYER, Denon DCD 1300, single play, remote control, perfect working order, $200. 626/281-2179, Mike.

CHINA, Haviland, beautiful yellow rose pattern, 24 pieces, circa 1985-1910, $350. 626/793-1895.

CHINA SET, 60 pieces for $70/obo. 909/592-0780, Ana.

CLOCK RADIO, portable, with emergency light; battery or AC operation, in original box (Lloyds Model J144), $18. 548-9151.

COFFEE TABLE, glass and brass; round, with two revolving levels, $35. 310/937-5923.

COMFORTERS, x-lg. king, lightly quilted, blue, $30/obo; 2 matching twins, x-long w/bright flowers on black background. 626/398-4960.

COMFORTERS (2), bedspreads 2, blankets, $35. 213/617-2398.

COMPUTER, AST Advantage, 486 DX2 66MHz w/integrated monitor; 24MB RAM; keyboard & mouse; Windows 95 w/MS Internet Explorer v.3.0, integrated Super VGA 1280 x 1024 14" color monitor; 850 MB IDE hard drive; Sportster 56K internal modem; 4X IDE CD ROM drive; 3½" floppy drive; Adaptec SCSI controller; Sound Blaster 16 sound card; software: Microsoft Office 97 (Access, Binder, Excel, Outlook, PowerPoint, Word), Norton Utilities, AntiVirus and CrashGuard; $400/obo. 626/355-9733.

COMPUTER, laptop, good-as-new Toshiba T2130CS; 75 MHz Intel DX4, 8 MB RAM, expandable to 32; 0.52 GB HDD; 10.4" dynamic-STN dual scan display, 3.5" floppy drive, serial and video ports, built-in power supply, rechargeable battery, 28.8 BPS modem card and phone cable, full documentation, Windows 95, carry case; almost never used; original cost $1,700, sell for $450. 626/797-5323.

COMPUTER, Leading Edge, model D, 2 FD, 5.25," 360 KB, MS DOS 3.10, Phoenix 8088 ROM, BIOS V.E, 649K RAM, 14" Amber monitor, working, $25. 541-0062.

COMPUTER, Mac II FX, Conner 30170E HD, 780 KB 3.5" FD, 1.4 MB 3.5"; Global Village Teleport 33.6 fax/modem; system 7.5.3; Netscape Communicator Pro 4.04; 20 MB RAM, 32-bit addressing memory; 14" color monitor; $250. 541-0062.

COUCH, L-shaped, white and light-blue stripes, very clean, $75. 310/937-5923.

CROCK POT square by Rival with Corningware, $15/obo. 626/568-8298.

DESK, brown, 2 small and 2 large drawers, clean, $25. 310/937-5923.

DESK, with rolling chair, computer pullout keyboard tray, two drawers, light brown with black accents, $30. 310/392-2190.

DODGER TICKETS: part of season tix pkg; 2nd deck, 3rd base, 10 rows up; sell at face value: $21/seat,4 tix/game; choice of up to 10 games in 1999. 790-5902.

DRYER, gas Whirlpool, white, gd. cond., $95. 626/795-5235.

EXERCISE EQUIPMENT, Nordic Ab work toner, includes extra weights and video, exc. cond., $50. 249-5736.

EXERCISE EQUIPMENT, rowing machine, Precor, with LCD readout and adjustable power stroke settings, $42. 548-9151.

FAN, electric, 7", $10. 213/617-2398.

FREEZER, Hotpoint, 10 cubic ft., $75. 790-6738.

FURNITURE, cherry oak coffee table, good condition, $30; 6' white bamboo couch, $40; 5' blue plaid couch, $20; cherry oak sewing machine table, $40. 626/791-7081

FURNITURE for girl's bedroom, double dresser, desk, corner unit, 2 hutches, end table, mirror; exc. to vg cond., $450. 626/355-8491.

FURNITURE: 5-piece dinette set, $75; full bed, including Simmons Majesty mattress, box spring, frame, $65; floor lamp, $10. 626/577-8107.

FURNITURE: dining table with 6 chairs; glass top dining table with 4chairs; floral print sofa with matching love seat; leather sectional sofa; daybed with mattress & pillows. 790-8216.

HEATER, electric, Rival company, 1500 watts and 1300 watts, $10. 213/617-2398.

ICE CHEST, 20-qt. size, $10; 6-pack size, $5. 213/617-2398.

JEWELRY, costume, various prices, incl. necklaces, earrings & pins (brooches). 626/398-4960.

LAMPS, dec. items; 2 gold welding art lamps, new shades, and end tables; $300. 626/447-5768.

LAWNMOWER, 20" front throw reel type, good cond., $75. 626/963-1364.

LUGGAGE, 22" Samsonite Ultralite3, $75. 790-0801.

MATTRESS, king size, and box springs (2); very clean, 2 years old, extra firm, exc. cond., forest green and white floral linens included; $100. 323/255-5220.

MODEM, Apple Geoport adapter fax/modem, model M1694 express, new, $25. 541-0062.

MOVING SALE: washer, Kenmore 80 series extra capacity, and dryer, Speed Queen heavy duty, $375/obo; sofabed, exc. cond., $350/obo. 626/568-8818, lv. msg.

ORGAN, antique pump, western cottage organ style #11 made by Cottage Organ Co. Ltd. Ottawa, circa 1892; $500/obo. 323/258-6039 or e-mail ao016@lafn.org.

PHOTOGRAPHS, 40" x 30", color, framed, 2 tall-ship pictures taken by prof. photog., vg cond.; 1 of Spanish tall ship in SF Bay, 1 of German tall ship taken near Puerto Rico; $75/each, $130 for both/obo. 626/568-8298.

PIANO, Bachman and Sons upright, $150. 243-8255.

PICTURE FRAMES, three made of brass, 22" x 28", $7/each, $18 for all three/obo. 626/568-8296.

PLAYHOUSE, wood; 5' x 7' x 7' high, 3 windows, double Dutch door, built-in desk & shelf; redwood finish, knocks down for transport; $100/obo. 952-8803.

PRINTER, Xerox Diablo 630 with wheels/ribbons, excellent condition, $20/obo. 626/568-8298.

RING, amethyst & diamond, set in 14k gold, $120. 626/398-4960.

RUG, Chinese, 7' x 10' hand-tufted wool, colors/ berry, tan & pale green, vg condition, appraised at $900, sell $250/obo. 626/398-4960.

TABLES, coffee table (approx. 60 x 30); matching end table (approx. 24 x 27); exc. condition, oak with leaded glass inserts; $250/both. 626/296-1537.

TABLES, walnut, two 2.5-ft square end tables, one 3-ft diameter coffee table, $150 all three. 626/448-4383.

TABLE, dining room, round, mahogany, sits 8 with two extensions, almost new, comes with 6 matching chairs, picture on ERC board; $650/obo; matching China buffet, $950/obo; all for $1,400/obo. 909/592-0780, Ana.

TABLES, glass, four 2-shelf tables with brass feet, three make up a coffee table (one round 2.5-ft. dia., two "half-moon"), fourth is a

Continued on page 8

round end table (2.5-ft. diameter), $125/obo. 909/592-0780, Ana.
TELEPHONE ANSWERING MACHINE, General Electric, black, microcassette, voice time/day stamp, hardly used. 626/844-4383.
TELEVISION, RCA ColorTrak, 25-in., $50. 626/577-8107.
TELEVISION, Sony 19-in. color, with remote, great picture, works fine, $175/obo. 626/963-2565.
TV STAND, oak, on coasters w/storage below & VCR shelf, can easily accommodate up to 27" set, $50. 626/398-4960.
VACUUM CLEANER, Sunbeam canister style, $10. 213/617-2398.
VIDEO GAME, Sega Genesis cartridge & CD system, 4 controllers, 21 games, $200 for all/obo. 626/309-0429.
WEDDING DRESS, exc. cond., used once, in garment bag; white straight dress w/long sleeves, bow in back, $40/obo. 626/568-8298.
WEED WACKER, gas, "Eager Beaver" brand, $30. 243-8255.

VEHICLES / ACCESSORIES

'70 ARISTOCRAT travel trailer, fully self-contained, great condition, new water heater & window a/c, sleeps 6, 22' long, dual propane tanks, $1,500/obo. 805/251-7738, after 5:30 p.m. M-F.
'87 BMW 325; white with beige interior, 190k miles, 4-door, 5-speed, CD player, sunroof, good condition, $2,500. 626/446-4969.
'89 CADILLAC Sedan DeVille, 4.5L V8, power all, cc, 4-wheel anti-lock brakes, $3,100/obo. 830-0691.
'95 CHEVROLET Corvette, auto, red coupe, am/fm/cass/CD, 2 tops, GM extended warranty, 39K miles, $21,500. 790-6738.
'95 CHEVROLET Suburban 1500, 4WDR 52K miles, A/C w/rear air; pwr. steering, windows & locks; am/fm/stereo/CD, premium sound syst., running boards, towing pkg., wide tires, privacy glass and more; exc. cond., $24,500 firm. 323/550-8282, eves.
'91 CHEVROLET Camaro, 74k miles, baby blue exterior/light gray interior, loaded, AM/FM Kenwood stereo w/cassette and face attachment, pwr. steering, pwr. doors and windows, ABS brakes, air bag; $6,500/obo. 875-4744, Aaron.
'78 DATSUN 280Z, exc. condition, interior restored, new injectors & Seabring exhaust, 64,000 orig. miles, $2,700/obo. 626/791-2700.
'72 DATSUN 240Z rare model, auto, vinyl top, 1 owner, orig. paint, interior restored, dual Webber carbs, Dynomak exhaust, rebuilt from ground up, a true classic; book $9,500, sell $4,500/obo. 626/791-2700.
'91 FORD Taurus, a/t, a/c, cruise, new tires/transmission, 97,000 miles, $4,500/obo. 626/447-4028.
'86 FORD Tempo, 2 door, 135,000 miles, $1,475/obo. 626/355-8574.
'85 FORD F150 XLT Lariat, 5.0 V8, auto, loaded, short bed w/shell, exc. cond., tow pkg., $3,950/obo. 323/255-9016.
'96 GEO Tracker sport utility 4D, black, 4-cly, automatic trans., 28,000 miles, air, am/fm cassette, roof rack, privacy glass, premium wheels, 2 air bags, $10,000. 626/296-7326 or 818/891-8168.
'97 HONDA Civic, green with cloth interior, 2 door, excellent condition, automatic, sun roof, alarm, ~29k miles, must see; must sell right away; $12,500 firm. 626/446-4969.
'90 HONDA Accord EX coupe; original owner; sunroof, auto, a/c, ps/pb; exc. mechanical condition; paint like new; maroon w/ivory interior; 120K mileage; $6,200/obo. 626/296-1537.
'87 HONDA Accord DX coupe, blue, excellent running condition, $2,800. 365-3799, Dave or Lucy.
'92 LEXUS ES300, gold, 5 spd., ~16,000 miles, mint cond.; leather, sunroof, heated seats, 6 CD changer, remote keyless entry, $19,000/obo. 626/568-8298.
'93 MAZDA Protégé, a/t, good cond., 73K miles, $4,500/obo. 626/447-4028.
'88 MAZDA RX7, GTU, rotary engine, 5-speed, silver, 115K miles, a/c, sunroof, alarm, $3,200. 626/355-7017.
'86 MERCEDES BENZ 190E, champagne color, 4 door, auto, 1 owner, $3,000 even. 790-3802, Bill.
'88 NISSAN Sentra E wagon, blue, new transmission, 126K miles, automatic, reliable, single owner, hitch, am/fm cassette, rear defrost, intermittent wipers, tilt wheel, $1,200 firm. 626/432-6955, Pat.
RADIO/CASSETTE, Coustic company 50 watt, auto reverse, digital AM/FM with Dolby NR, $40. 213/617-2398.
'93 SAAB 900, one owner, ABS brakes, air, leather, sunroof, etc., $7,000/obo. 805/251-3854.
'96 SEADOOs (2) watercraft; 2-seater GSX, 3-seater GTI w/dbl. trailer, $10,000. 760/252-1795, eve.
'96 TOYOTA Previa, supercharged, sunroofs, CD player w/cassette, $19,000/obo. 541-0131.
'86 TOYOTA Camry, 4 door, loaded, auto, a/c, power windows, radio/cass., below Blue Book, $2,600/obo. 790-6283, after 5 p.m.

LOST & FOUND

Found: Ladies watch in parking lot along the arroyo below B171 & B200;call Andre at 4-1126 and identify.

FREE

CAT, orange male, friendly with people and dogs. 626/791-0809.
DOG, Maltese terrier, white spayed female, 6 yrs. old, sweet disposition, friendly with dogs, cats, people. 626/791-0809.
MATTRESS/BOX SPRINGS, California King, Sealy Posturepedic, gently firm, good condition, very clean. 790-4860.

WANTED

ANSWERING MACHINE, digital. 626/791-7081.
HOUSE for lease or rent in La Canada, available starting now through June, 3 bedrooms preferred. 626/794-2758, Betsy Wilson.
HOUSEMATE to share 3-bd., 2-ba. house in San Gabriel; quiet cul-de-sac, 9 miles/JPL; all amenities included; $500. 626/281-2179, Mike.
JOGGING STROLLER. 626/355-8574.
PIANO, upright, for beginner student. 952-8032.
PIANO, will consider console to baby grand; VIOLIN, 3/4. 626/797-6824.
SPACE INFORMATION/memorabilia from U.S. & other countries, past & present. 790-8523, Marc Rayman.
VANPOOL RIDERS from the Victorville area. 626/584-4443, Al Hewitt.

FOR RENT

ARCADIA, cozy, furnished room; includes laundry, kitchen privileges, pool; no smokers, $350. 626/448-8809, Shary.
EAGLE ROCK house, art deco, spacious, sunny, clean; lg. yd., office space, view a/c, appliances, fireplace, garage; avail. April 25; 5812 Tipton Way, $1,100. 626/794-7281.
LA CRESCENTA house, N. of Foothill; 3 bd., 1½ ba., living rm. w/fireplace, formal din. room, spacious kitch., bkfast area, laundry rm., detached 2-car garage, fenced backyard, sprinkler, gardener pd., $1,300. 790-9772.
MONTROSE, roommate wanted to share 2-bd. apt., 5 minutes from JPL, $370 + 1/2 util. 541-0794.
PASADENA, fully furn. studio condo, gated complex, 1115 E. Cordova, 2 blocks N./Caltech at Wilson Ave.; carport, pool, patio and laundry facilities on premises; non-smoker, no pets; $675 + electric. 626/792-9053, Marilyn.
PASADENA, share 3-bd., 3-ba. apt. with Caltech post-doc; fully furn., laundry facil., parking space; 3 mi./PCC & Caltech, male pref., $400 + 1/3 util. 626/351-9641.
ROOM in lg. house, shared ba., close to JPL, nice neighborhood; req. non-smoker, clean, must like dogs. 797-5570.
SHARE 2 bd., 1½ ba. w/JPLer, laundry facil., 3 mi./Caltech & PCC, avail. 4/30, $387.50 + ½ util. 626/449-6882, Denis.
SOUTH PASADENA, fully furnished studio apt., nice area at 1718 Huntington Dr., between Marengo and Milan Sts, car space, laundry facilities on premises, utilities paid; non-smoker, no pets; $565. 626/792-9053, Marilyn.

REAL ESTATE

BIG BEAR, new cabin 2 blocks from lake, 2 bd., 2 ba., mud/laundry room, $129,000. 909/585-9026.
LA CANADA, 3 bd., 2 ba., Spanish style home in uniquely private verdant setting; near Montrose shops, park with tennis ct.; solar water for house and spa; hardwood floors, Berber carpets, Corian kitchen, cul de sac; central heat/air; La Canada schools; $397,000. 249-8088.
LA CANADA, ranch style, 1,800 sq. ft., 4 bd., 2 ba., LR, FR, kitchen, laundry rm., breakfast nook, 2-car attached garage, 15,000 sq. ft. lot, 2 fireplaces, 40+ trees, corner lot, near schools, 1.5 miles/JPL, vg cond. 790-8368.
N. GLENDALE condo, 2 bd., 1¾ ba., mtn. sunset view, d/w, cent. a/c, balcony, 2 covered parking spaces, pool, Jacuzzi, rec. rm., pictures at http://www.skynet/~pjs; $124,000. 956-6336.
PALM DESERT, exquisite, 2 bd., 2 ba. villa for vacations or long term, newly remodeled, w/skylight, patio & 2-car garage; located across the Living Desert, great private, secure resort w/tennis cts., multiple pools & spas and clubhouse facilities; great locality, around 2 top resorts. 909/620-1364.

VACATION RENTALS

BIG BEAR, 7 mi. from slopes; full kitchen, f/p, 2 bd., 1 ba., sleeps 6; reasonable rates; 2-night minimum; no smokers, no pets; exc. hiking, biking, fishing nearby. 909/585-9026, Pat & Mary Ann Carroll.
BIG BEAR cabin, quiet wooded area near village, 2 bd., sleeps 8, completely furnished, F/P, TV/VCP, $75/night. 249-8515.
BIG BEAR CITY, 4 miles/ski slopes, 2-bd., 1-ba. cabin, nicely furn., sleeps 8; fireplace, TV, full kitch., microwave; $100 refundable cleaning deposit; $75/nite weekdays, $250/weekend (2 nites). 909/982-2986.
BIG BEAR LAKE cabin, near ski area, shops, village, forest, lake; 2 bd., sleeps up to 6, fireplace, TV, VCR, phone, microwave, BBQ and more; JPL disc. price from $65/night. 909/599-5225.
BIG BEAR LAKEFRONT lux. townhome, indoor pool/spa, nr. skiing, beaut. master bdrm. suite, sleeps 6. 949/786-6548.
CAMBRIA, ocean front house, exc. view, sleeps up to 4. 248-8853.
CORNWALL, ENGLAND, August 1999 total solar eclipse; prime location campsite on the path of totality; includes lecture series by Caltech, JPL and UK astronomers; http://www.ctg-windows.co.uk/ eclipse.html. 626/356 2998.
HAWAII, Kona, on 166 feet of ocean front on Keauhou Bay, private house and guest house comfortably sleep 6; 3 bd., 2 ba.; rustic, relaxing and beautiful; swimming, snorkeling, fishing, spectacular views; near restaurants, golf courses and other attractions; low season rates begin May 1. 626/584-9632.
HAWAII, Maui condo, NW coast, on beach w/ocean vw., 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, microwv., dishwasher, pool, priv. lanai, slps. 4, 4/15-12/14 rate: $95/nite/2, 12/15-4/14 rate: $110/nite/2, $10/nite/add'l person. 949/348-8047.
HAWAII, Oahu, certificate good for 1-2 adults, Sun., Mon., Tues. arrival, 4 nights accommodations, airfare not incl., expires June 30, $200. 626/917-0231.
LAKE TAHOE, North shore, 2 bd., 2-1/2 ba., sleeps 6-7, great location, all amenities, private sandy beach, pool, walk to golf course, fishing 150 yards from front door, 2 miles to casinos, JPL discount rate, book now for summer (by the week only after June 15). 626/355-3886, Rosemary or Ed.
MAMMOTH, Snowcreek, 2 bd., 2 ba., + loft; sleeps 6-8; fully equip'd kitch. incl. microwave, D/W; cable TV, VCR, phone, balcony w/mtn. view, Jacz., sauna, streams, fishponds; close to Mammoth Creek; JPL discount. 626/798-9222 or 626/794-0455.
MAMMOTH condo in Chamonix at lifts 7, 8, 16, 17; walk to Warming Hut, 2 bd., 2 full ba., slps. 6, fully eqpd. elec. kitch., microwv. & extras, frplc./wood, color TV, VCR, FM stereo, o/d Jacz., sauna; gm., rec. & lndry. rms., walk to shops, lifts; spec. midwk. rates. 249-8524.
MAZATLAN, week of Oct. 11-18, 7 nites, Pueblo Bonito resort, 1 bd., sleeps 6, on the beach, partial kitchen, airfare not included, $1,050. 626/917-0231.
OCEANSIDE, on the sand, charming 1 bd. condo, panoramic view, walk to pier or harbor, pool, spa, game rm., sleeps 4. 949/786-6548.
PACIFIC GROVE house, 3 bd., 2 ba., fp, cable tv/vcr, stereo/CD, well-eqpd. kitch. w/microwv., beaut. furn., close to golf, beaches, 17 Mile Dr., Aquarium, Cannery Row, JPL discount. 626/441-3265.
PALM DESERT, exquisite, 2 bd., 2 ba. villa for vacations or long term, newly remodeled, w/skylight, patio & 2-car garage; located across the Living Desert, great private, secure resort w/tennis cts., multiple pools & spas and clubhouse facilities; great locality, around 2 top resorts. 909/620-1364.
S. LAKE TAHOE Keys waterfront home, 4 bd., 3 ba., slps. 12+, 2-lev. frplacs, decks overlk. priv. dock/ski lifts, gourm. kitch., bikes, boats, color TVs, VCR, ster. w/tape/disk, pools, hot tub & bch.; tennis, 10 min./skiing, casinos/golf, 1 hr./wine cntry; $995/wk. hi seas. [15 June to 15 Sept; 22 Nov. to 1 March]; + $90 clean fee; 3-day min. 626/578-1503, Jim Douglas.

NOTICE TO ADVERTISERS

All housing and vehicle advertisements require that the qualifying person(s) placing the ad be listed as an owner on the ownership documents.

Universe

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Mark Whalen

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JPL Photo Lab

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Ads must be submitted on ad cards, available at the ERC and the Universe office, Bldg. 186-118, or via e-mail to **universe@ jpl.nasa.gov**. E-mail ads are limited to six lines.

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To change an address, contact your section's administrative assistant, who can make the change through the HRS database. For JPL retirees and others, call Xerox Business Services at (626) 844-4102.